User Events in Cocoa

Session 117

These are confidential sessions—please refrain from streaming, blogging, or taking pictures.

User Events in Cocoa

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Overview

Only on Mac OS

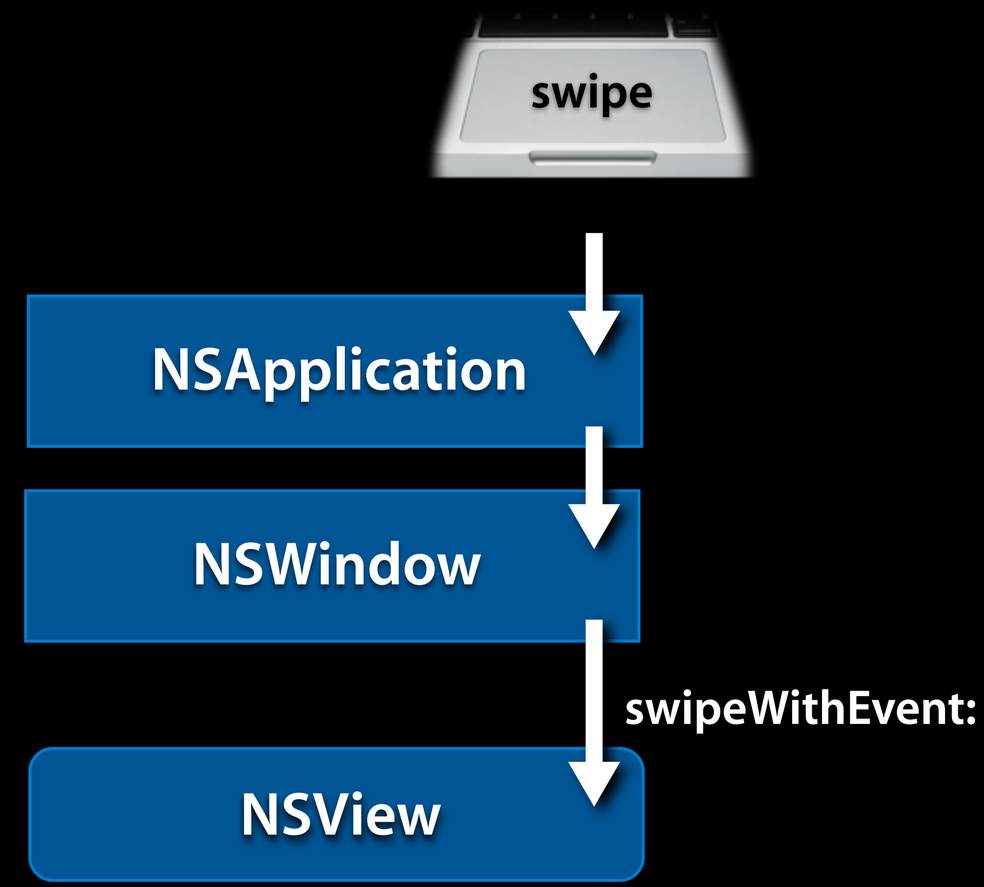
- Event routing and responder chain
- Gesture and multi-touch API
- Event monitoring

Processing Multi-Touch Events on iPhone

Pacific Heights
Thursday 9:00AM

Event Routing

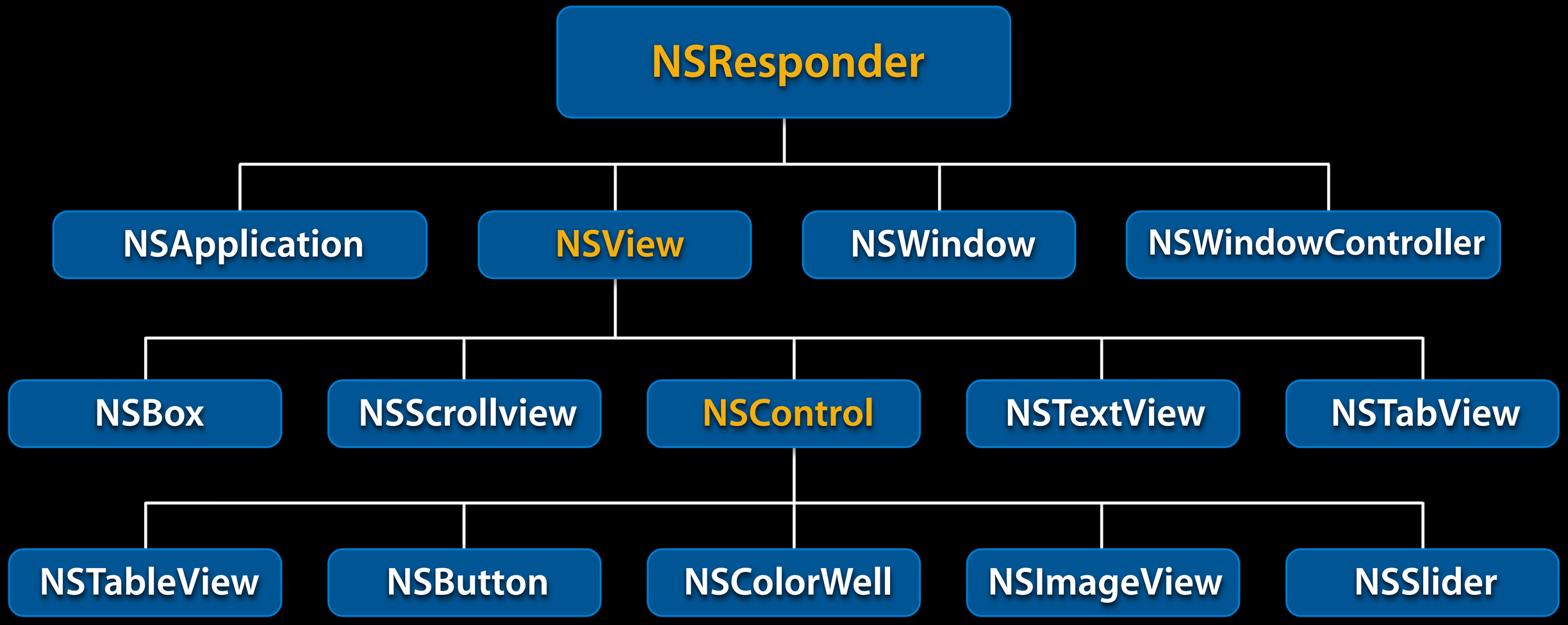
Event Routing



Event Routing

NSView

NSResponder Inheritance



NSResponder

NSResponder

NSResponder


```
mouseDown:(NSEvent *)event
mouseDragged:(NSEvent *)event
mouseUp:(NSEvent *)event
```

```
magnifyWithEvent:(NSEvent *)event
swipeWithEvent:(NSEvent *)event
rotateWithEvent:(NSEvent *)event
```

```
keyDown:(NSEvent *)event
keyUp:(NSEvent *)event
flagsChanged:(NSEvent *)event
```

NSResponder

NSResponder

```
mouseDown:(NSEvent *)event
mouseDragged:(NSEvent *)event
mouseUp:(NSEvent *)event
```

```
magnifyWithEvent:(NSEvent *)event
- (void)swipeWithEvent:(NSEvent *)event;
rotateWithEvent:(NSEvent *)event
```

```
keyDown:(NSEvent *)event
keyUp:(NSEvent *)event
flagsChanged:(NSEvent *)event
```

NSResponder

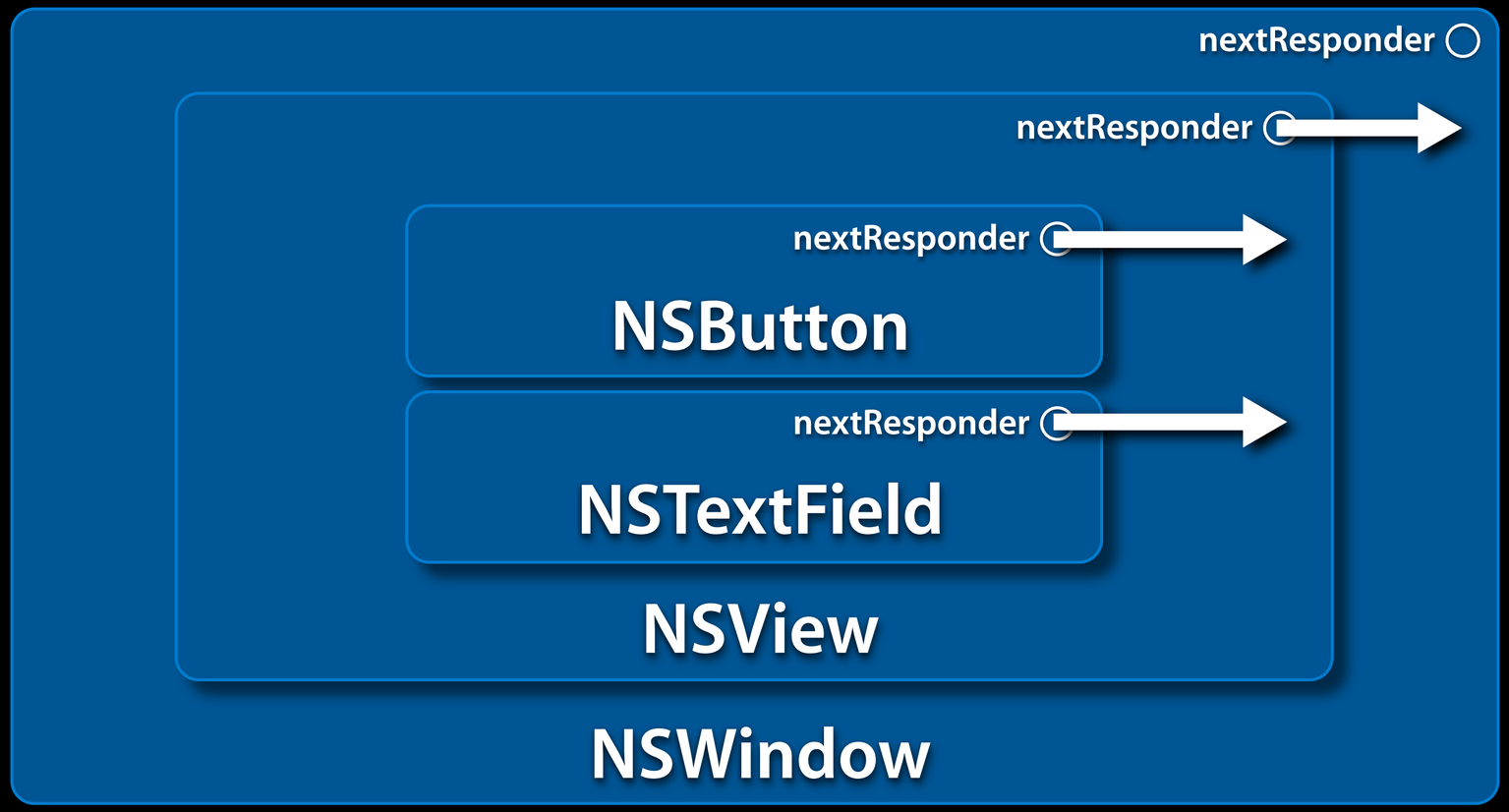
NSResponder

Responder Chain

Responder Chain

Responder Chain

View Hierarchy



Responder Chain

Responder Chain

- Event routing
- Action routing
- Automatic menu enabling
- Error presentation

Responder Chain

- Responder Chain for Action Messages
- Automatic Menu Enabling
- Error Handling Programming Guide for Cocoa

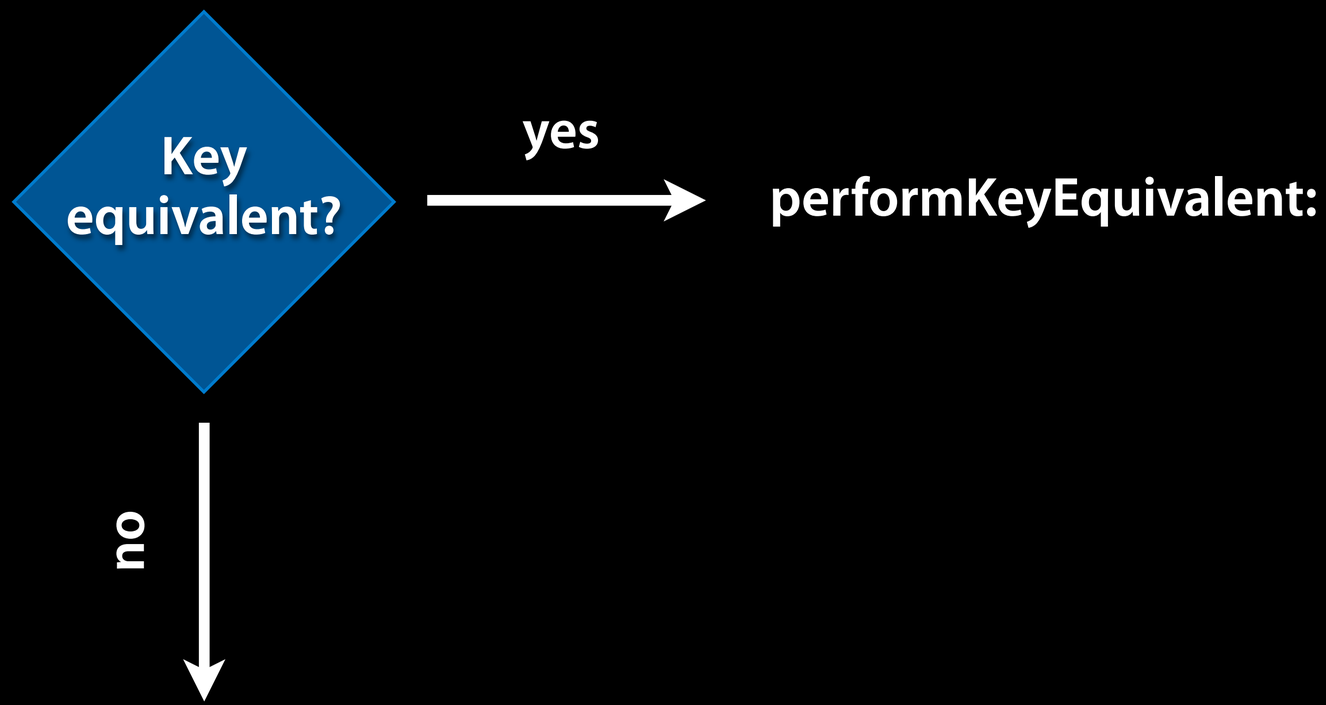
Event Types

Event Types

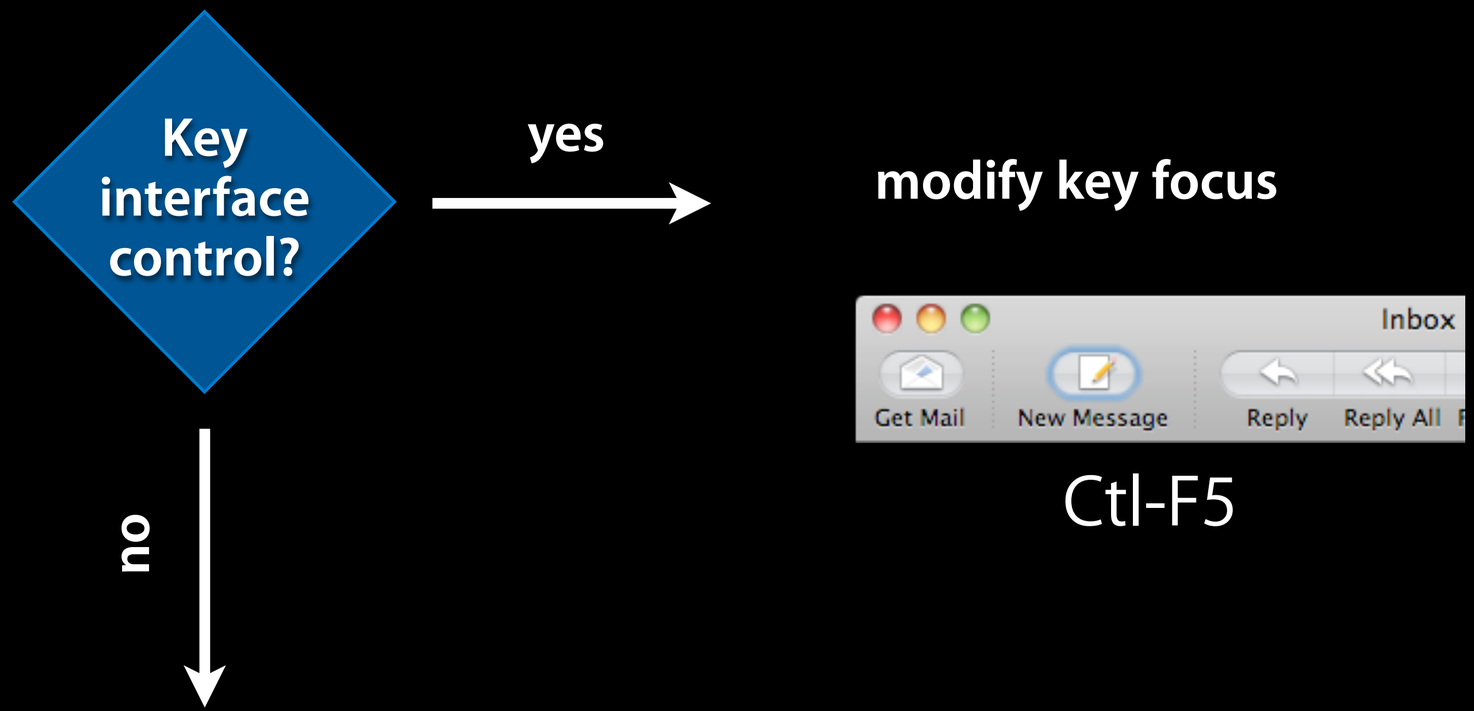
- Keyboard
- Pointer

Keyboard Events

Keyboard Events



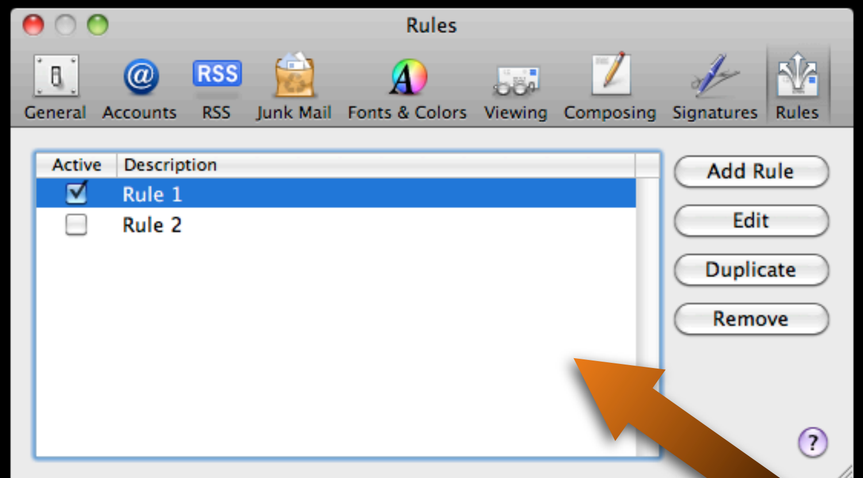
Keyboard Events

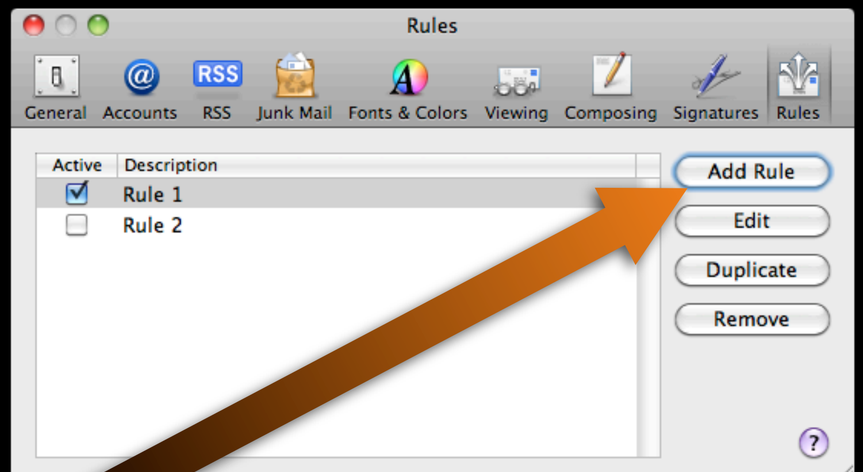


Keyboard Events

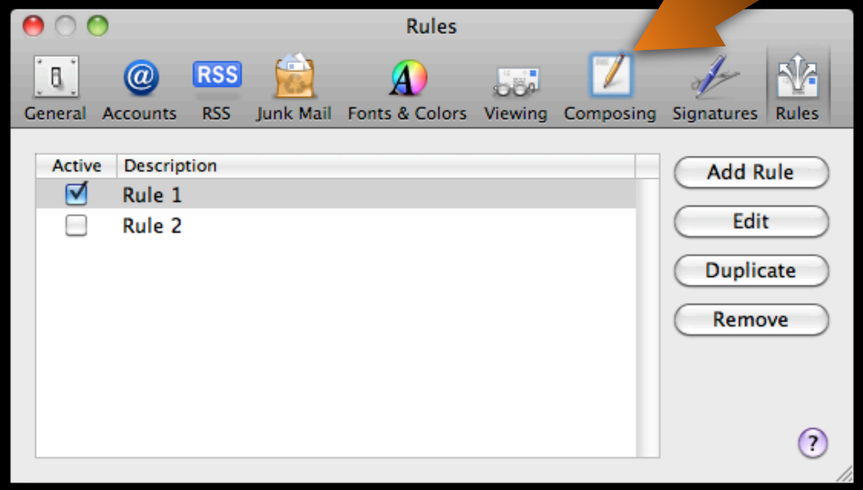
FirstResponder

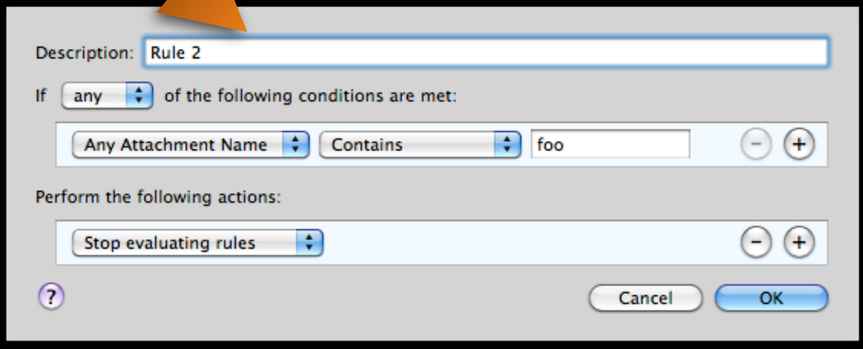
Keyboard Events





FirstResponder

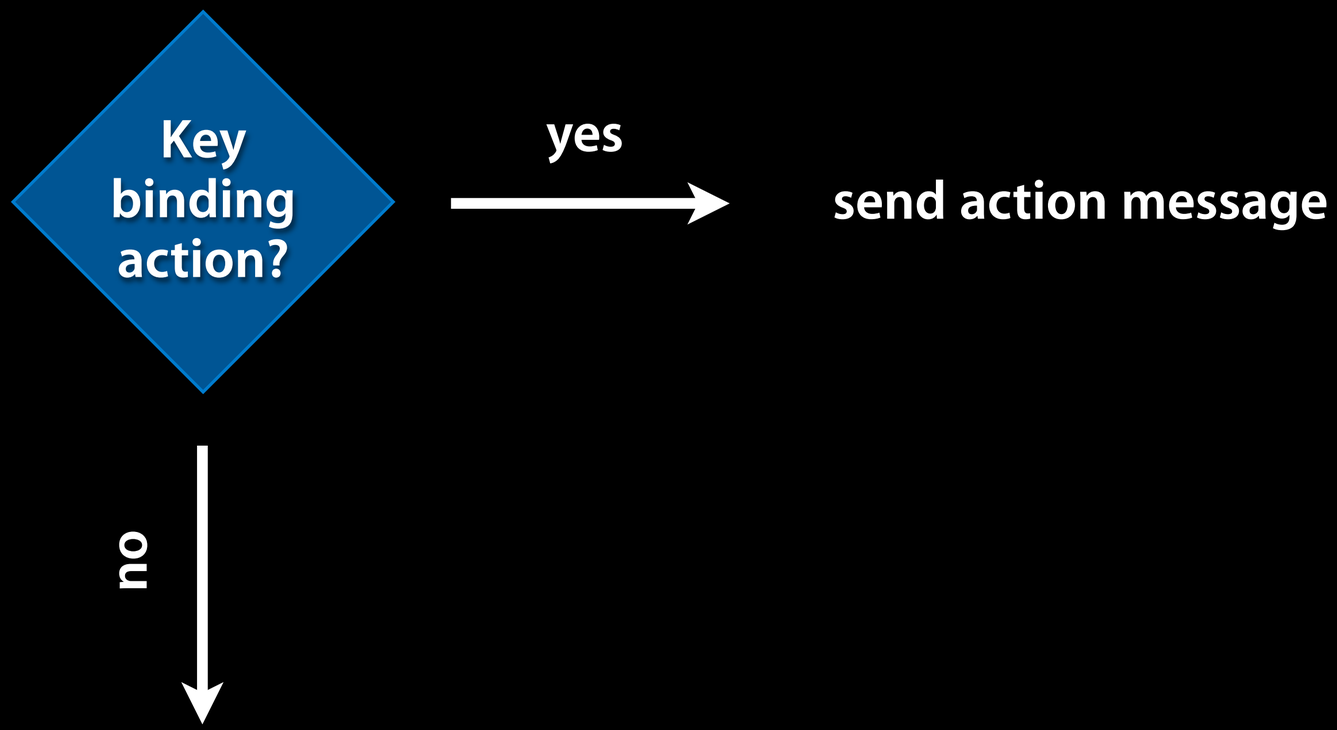




Keyboard Events

```
- (void)keyDown:(NSEvent *)theEvent {
    [self interpretKeyEvents:[NSArray arrayWithObject:theEvent]];
}
```

Keyboard Events



Keyboard Events

```
- (void)insertText:(NSString *)string;
```

Keyboard Events

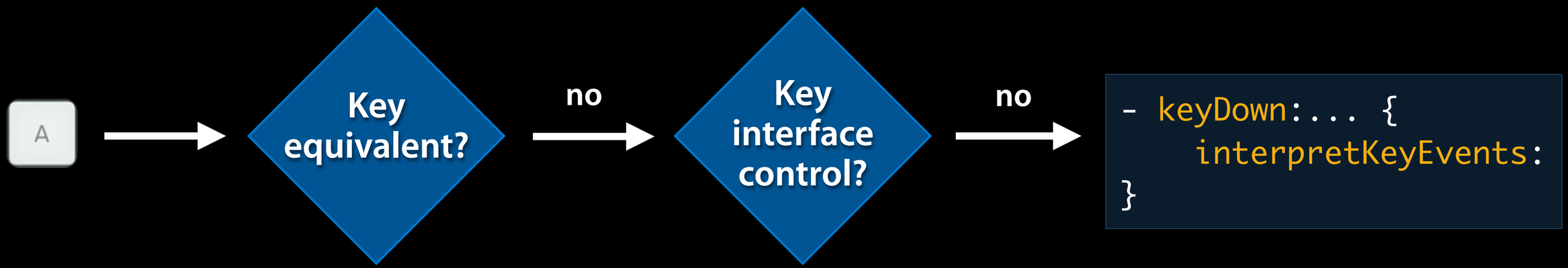
Example

Keyboard Events

Example

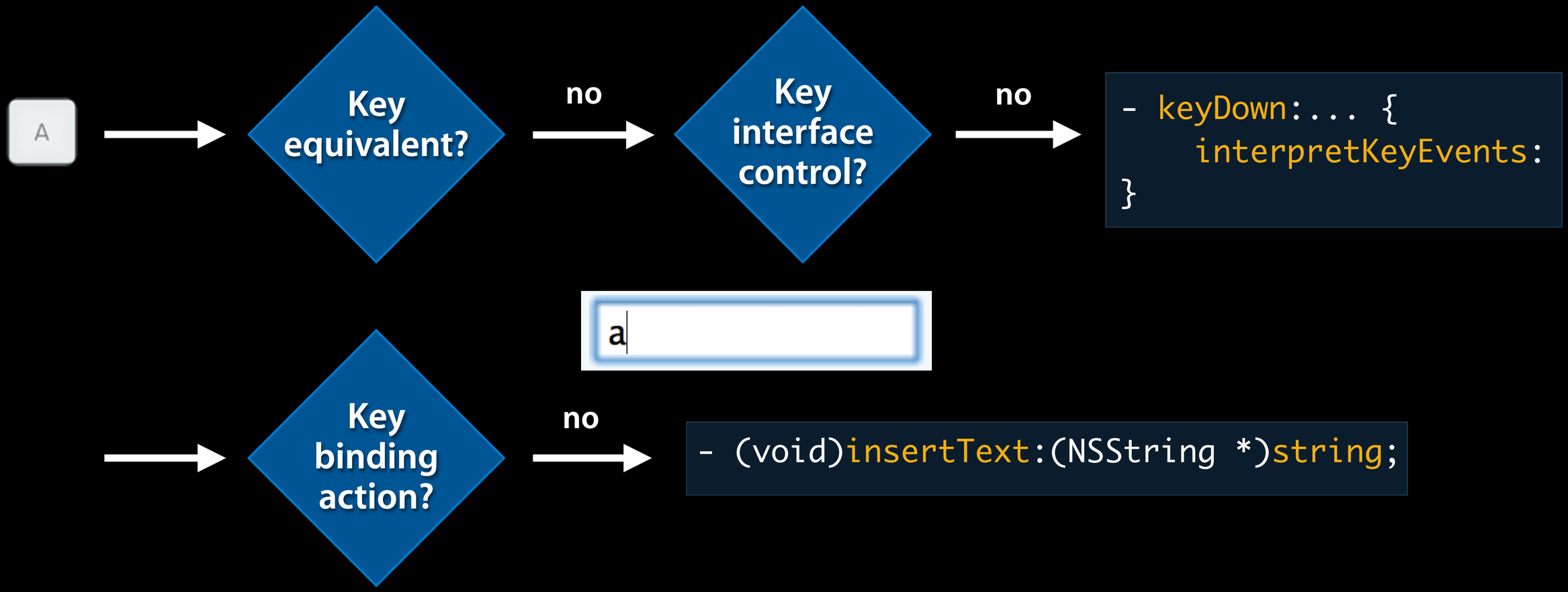
Keyboard Events

Example



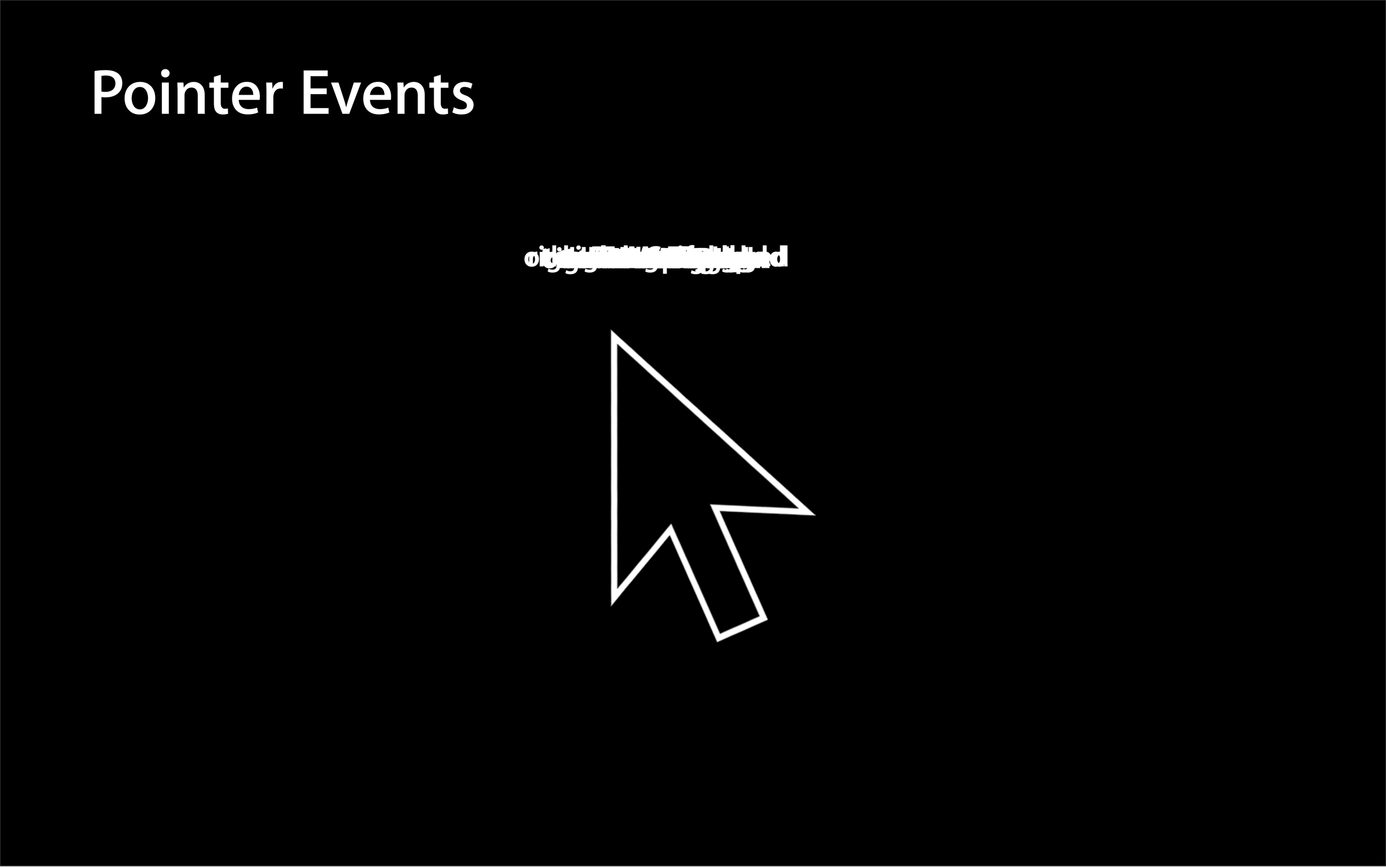
Keyboard Events

Example



Pointer Events

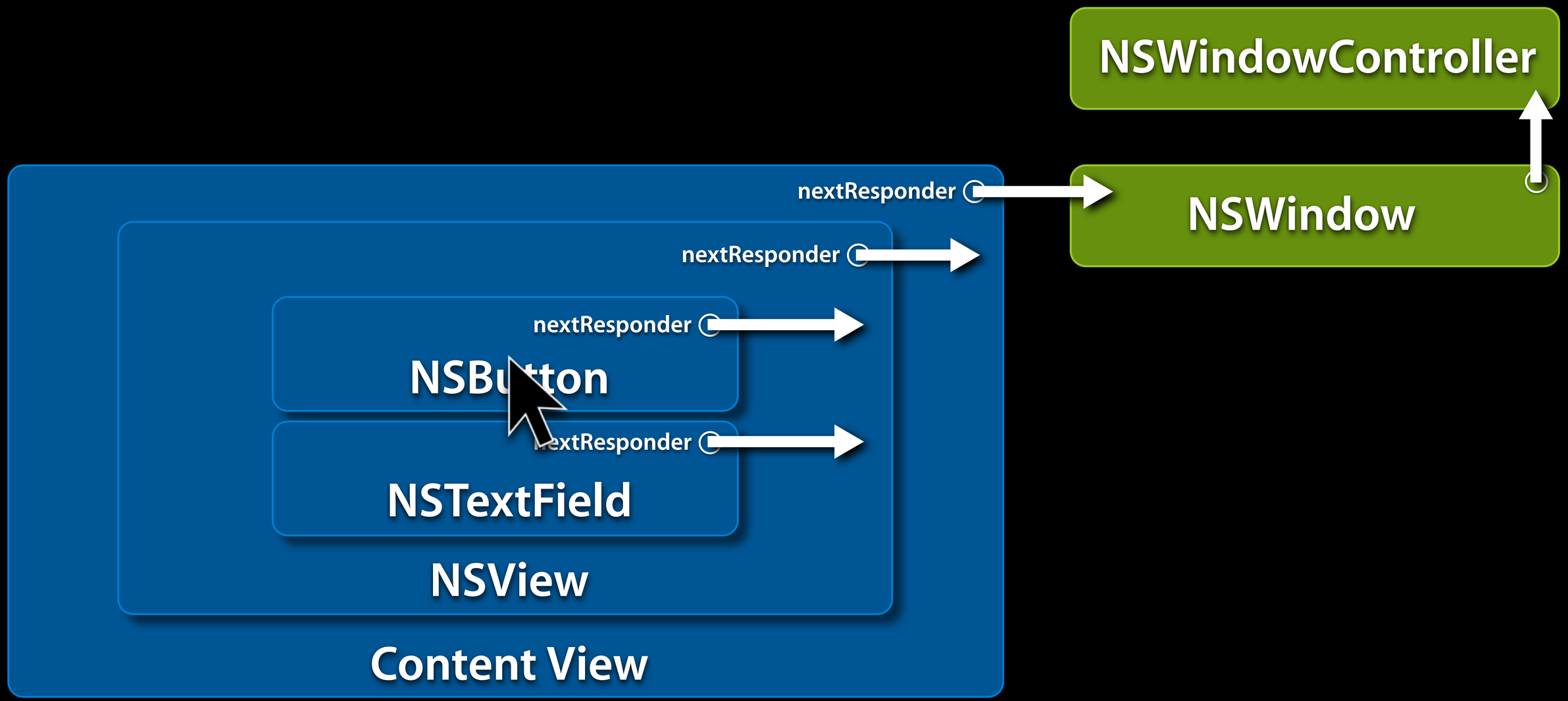
Pointer Events



Demo

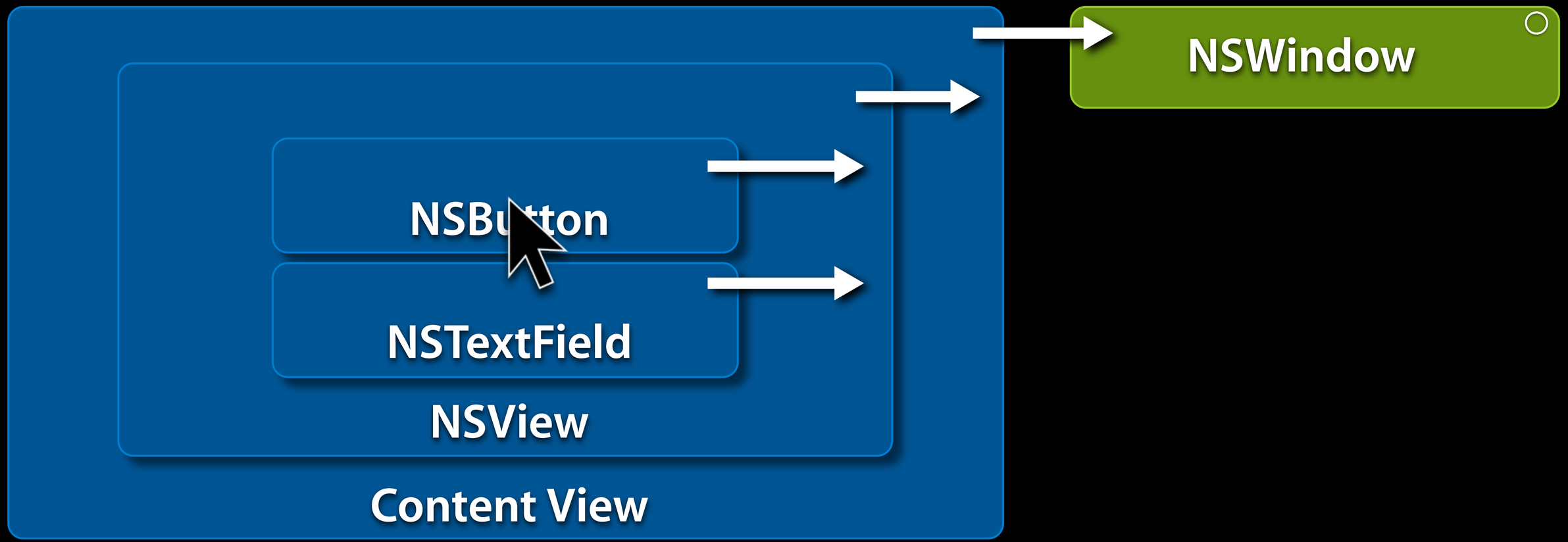
Pointer Events

Event routing



Pointer Events

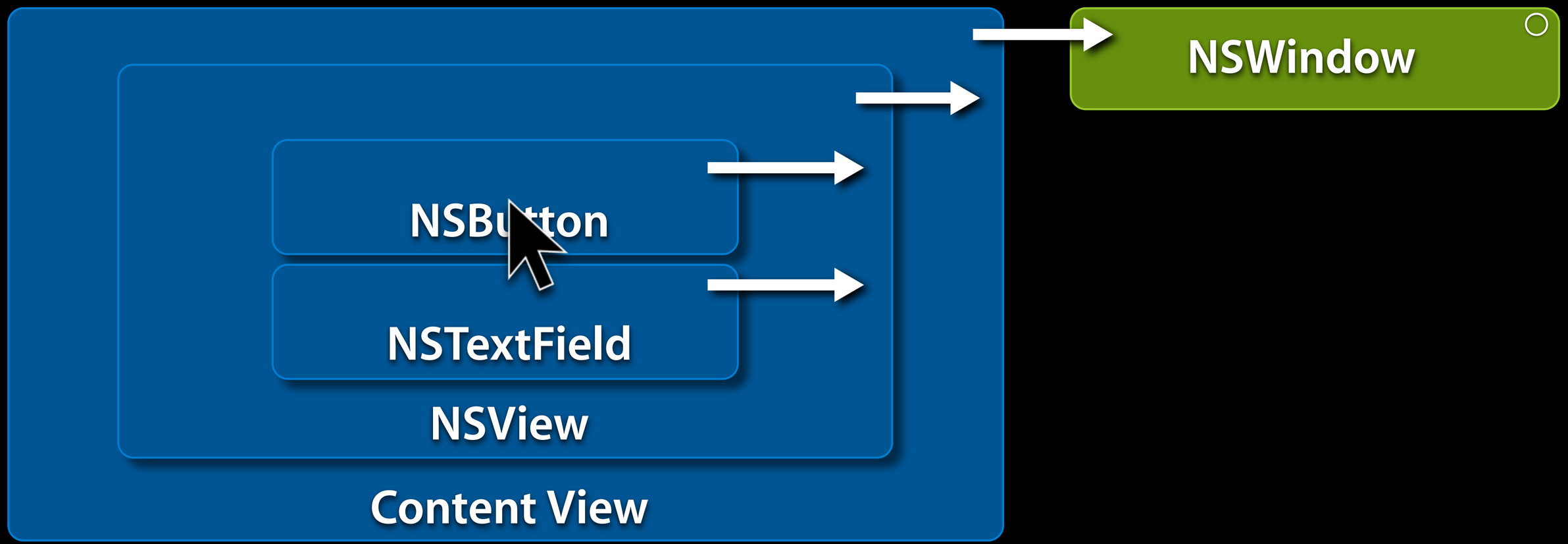
Hit testing



Pointer Events

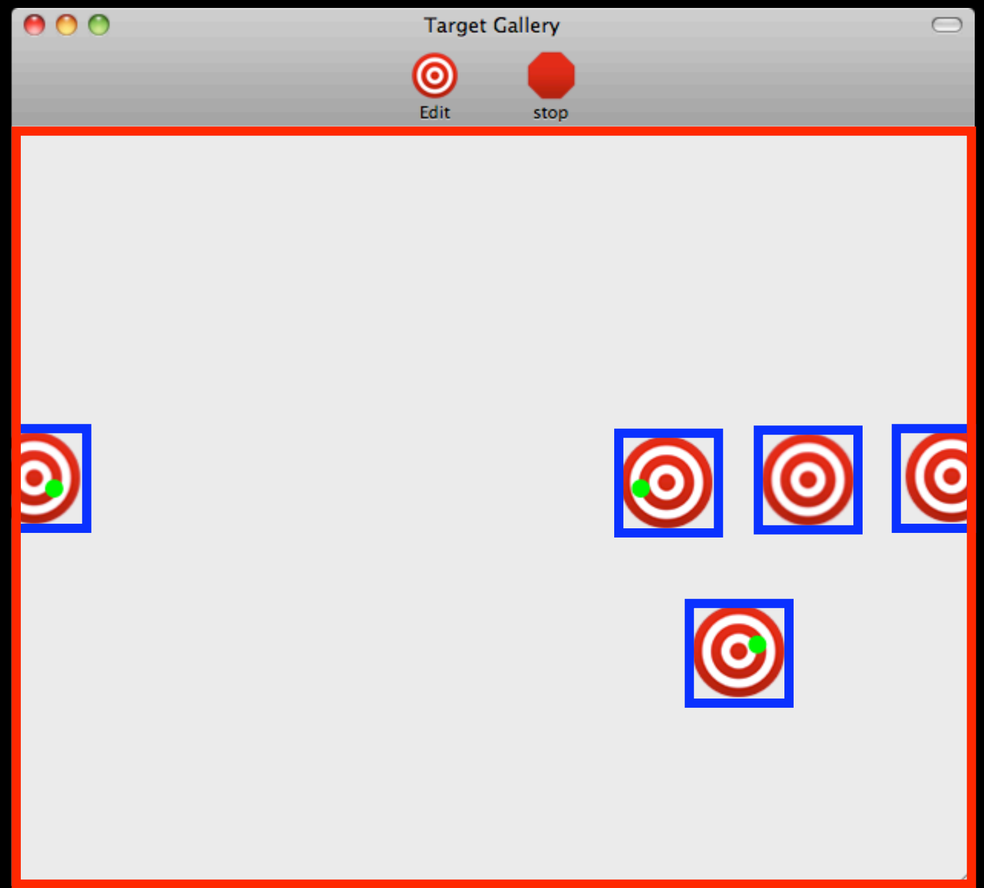
Hit testing

```
-(NSView *)hitTest:(NSPoint)aPoint
```



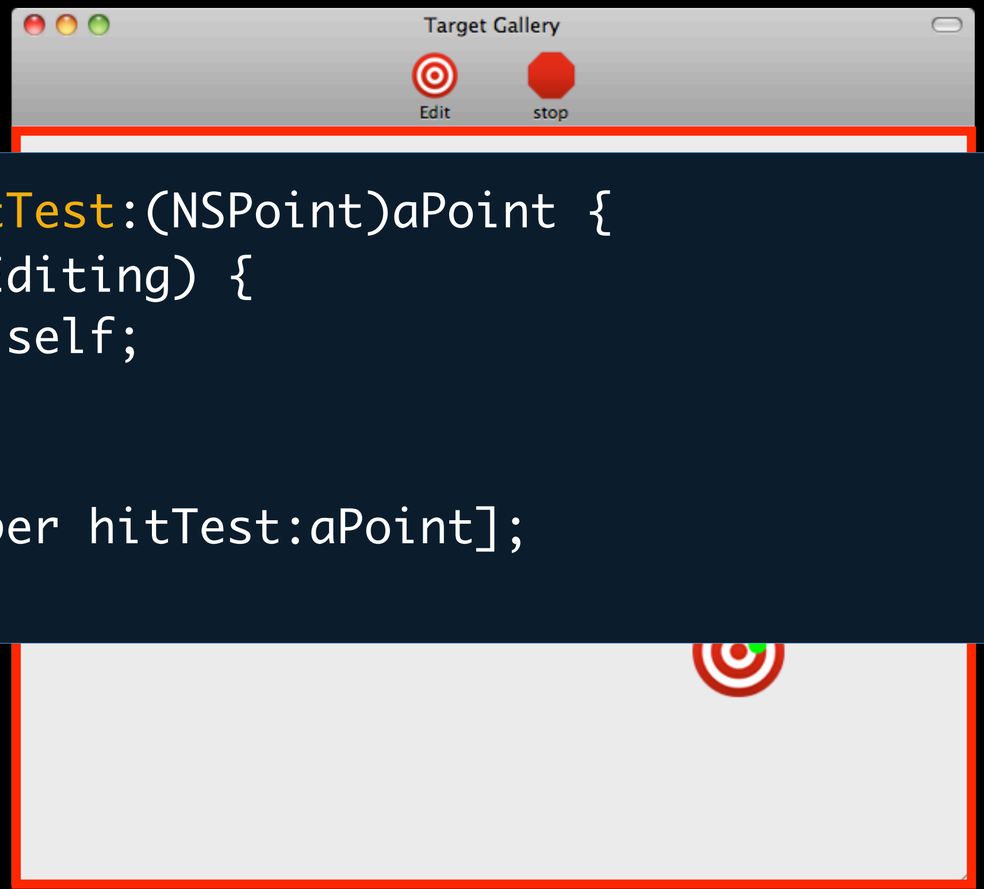
Pointer Events

Hit testing



Pointer Events

Hit testing

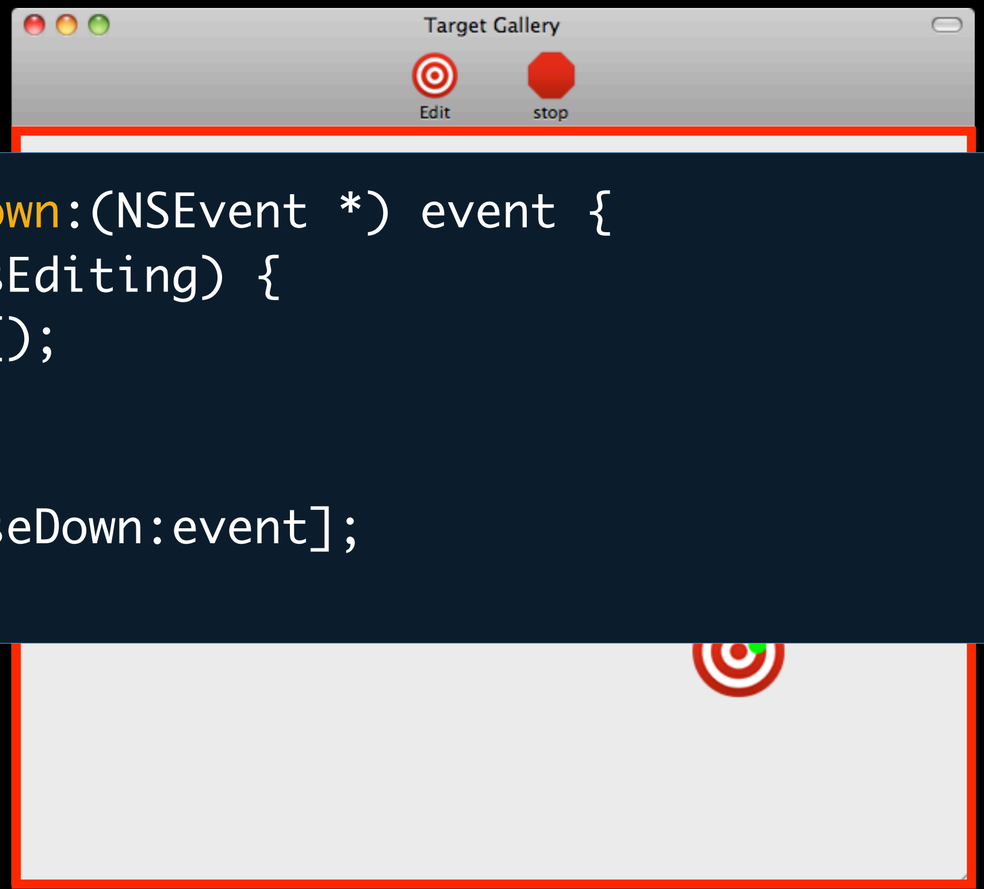



```
- (NSView *)hitTest:(NSPoint)aPoint {
    if(self.isEditing) {
        return self;
    }

    return [super hitTest:aPoint];
}
```

Pointer Events

Hit testing




```
- (void)mouseDown:(NSEvent *) event {
    if(!self.isEditing) {
        NSBeep();
    }

    [super mouseDown:event];
}
```

Mouse Events

Mouse Events

- Subtype
- Best practices
- `delta` vs. `locationInWindow`

Mouse Events

Subtypes

- Mouse
- Tablet
- Touch

```
... :(NSEvent *)event {
    NSInteger subtype = [event subtype];
}
```

Mouse Events

Subtypes

- Mouse
- Tablet
- Touch

Mouse Events

Subtypes

- Mouse
- Tablet
- Touch

deviceID

pressure

tangentialPressure

tilt

rotation

Mouse Events

Subtypes

- Mouse
- Tablet
- Touch

-tabletProximity:

-tabletPoint:

Cocoa Event-Handling Guide: Handling Tablet Events

Mouse Events

Subtypes

- Mouse
- Tablet
- Touch

Mouse Events

Best practices

- Use NSTrackingArea
- Use three-method tracking approach
- Drag thresholds

Mouse Events

Best practices

- Use NSTrackingArea
- Use three-method tracking approach
- Drag thresholds

Mouse Events

Best practices

- Using Tracking-Area Objects
- Use three-method tracking approach
- Drag thresholds

```
- (void)mouseDown:(NSEvent *)theEvent;

- (void)mouseDragged:(NSEvent *)theEvent;

- (void)mouseUp:(NSEvent *)theEvent;
```

Mouse Events

Best practices

- Using Tracking-Area Objects
- The Three-Method Approach
- Drag thresholds

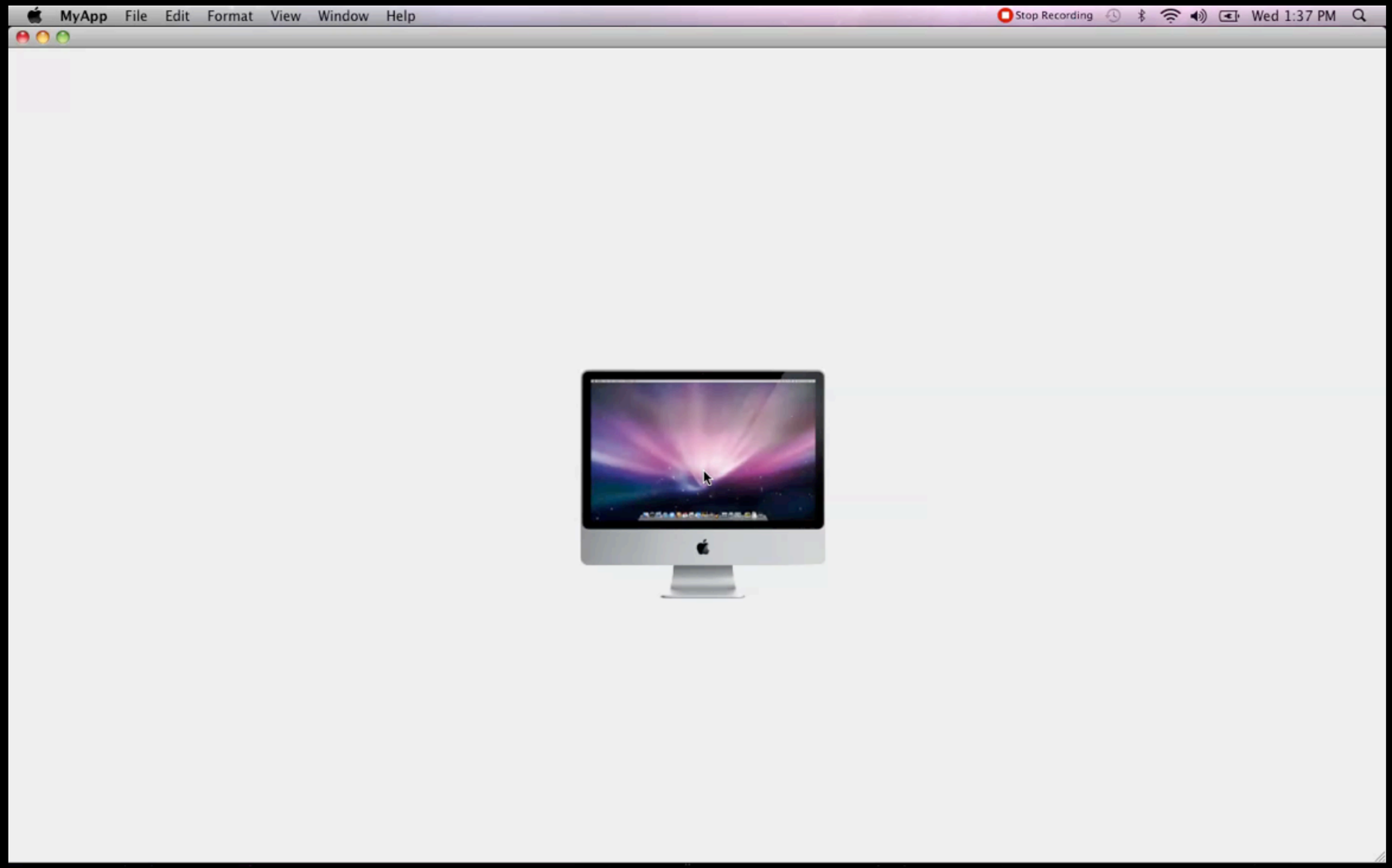
Mouse Events

`delta` vs. `locationInWindow`

```
- (NSPoint)locationInWindow;
- (CGFloat)deltaX;                - (CGFloat)deltaY;
```

Mouse Events

`delta` vs. `locationInWindow`



Mouse Events

delta vs. locationInWindow

- (NSPoint)locationInWindow;

```
- (void)mouseDragged:(NSEvent *)theEvent {
    NSPoint location = [theEvent locationInWindow];
    location = [self convertPoint:location fromView:nil];
    ...
```

Mouse Events

`delta` vs. `locationInWindow`

```
- (NSPoint)locationInWindow;
```

Align with cursor

View localized location of the cursor

Mouse Events

`delta` vs. `locationInWindow`

```
- (NSPoint)locationInWindow;
```

Align with cursor

View localized location of the cursor

```
- (CGFloat)deltaX;
```

Cursor location is irrelevant

Panning

```
- (CGFloat)deltaY;
```

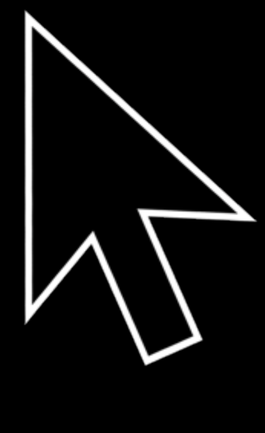
Gestures

Gestures

- Magnify
- Rotate
- Swipe

Gestures

10.5.2



- Magnify
- Rotate
- Swipe

Gestures

- Magnify
- Rotate
- Swipe

```
- (void)magnifyWithEvent:(NSEvent *)event {
    CGFloat change = [event magnification];
}
```

Gestures

- Magnify
- Rotate
- Swipe

```
- (void)rotateWithEvent:(NSEvent *)event {
    float degrees = [event rotation];
}
```

Gestures

- Magnify
- Rotate
- Swipe

```
- (void)swipeWithEvent:(NSEvent *)event {
    NSInteger horizontal = [event deltaX];
    NSInteger vertical   = [event deltaY];
}
```

Gestures

- Magnify
- Rotate
- Swipe

```
Left
[event deltaX] ==  1
```

Gestures

- Magnify
- Rotate
- Swipe

```
Right
[event deltaX] == -1
```

Gestures

- Magnify
- Rotate
- Swipe

Up

```
[event deltaY] ==  1
```

Gestures

- Magnify
- Rotate
- Swipe

Down

```
[event deltaY] == -1
```

Multi-Touch

New

Multi-Touch

Indirect

Direct

Multi-Touch

New

Multi-Touch

New

- Cursor location
- Similar hit testing as mouse
- All touches routed to same view

Demo

Multi-Touch

NSTouch

(NSTouchPhase) phase

(id) identity

(BOOL) isResting

(NSPoint) normalizedPosition

(NSSize) deviceSize

(id) device

Multi-Touch

NSTouch

(NSTouchPhase) phase

(id) identity

(BOOL) isResting

(NSPoint) normalizedPosition

(NSSize) deviceSize

(id) device

Multi-Touch

Touch phases

Began

Moved

Stationary

Ended

Cancelled

Multi-Touch

Touch phases

New

NSTouchPhaseBegan

Moved

Stationary

Ended

Cancelled

Multi-Touch

Touch phases

New

NSTouchPhaseBegan

Moved

Stationary

Ended

Cancelled

Multi-Touch

Touch phases

New

Began

NSTouchPhaseMoved

Stationary

Ended

Cancelled

Multi-Touch

Touch phases

New

NSTouchPhase

- Began
- Moved
- Stationary
- Ended
- Cancelled

Multi-Touch

Touch phases

New

Began

NSTouchPhaseMoved

Stationary

Ended

Cancelled

Multi-Touch

Touch phases

New

Began

Moved

Stationary

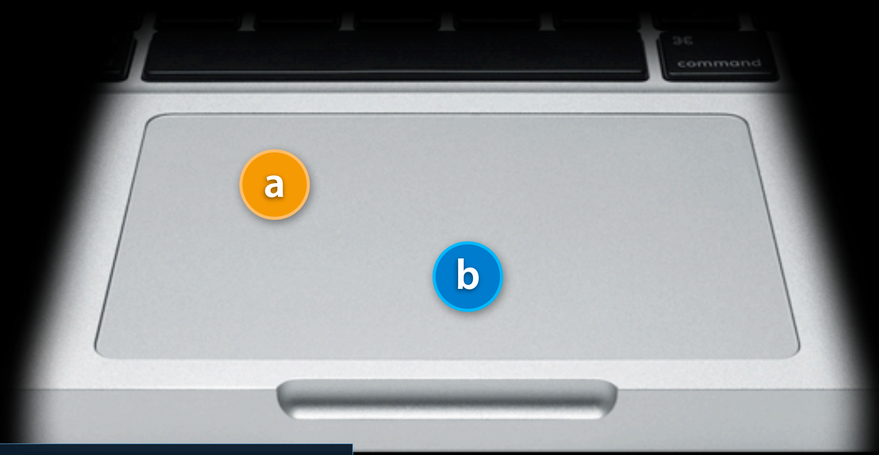
Ended

NSTouchPhaseCancelled

Multi-Touch

NSTouch

New



(NSTouchPhase) phase

(id) identity

```
[touch1.identity isEqual:touch2.identity]
```

(BOOL) isResting

(NSPoint) normalizedPosition

(NSSize) deviceSize

(id) device

Multi-Touch

NSTouch

New

(NSTouchPhase) phase

(id) identity

(BOOL) isResting

(NSPoint) normalizedPosition

(NSSize) deviceSize

(id) device

Multi-Touch

NSTouch

New

(NSTouchPhase) phase

(id) identity

(BOOL) isResting

(NSPoint) normalizedPosition

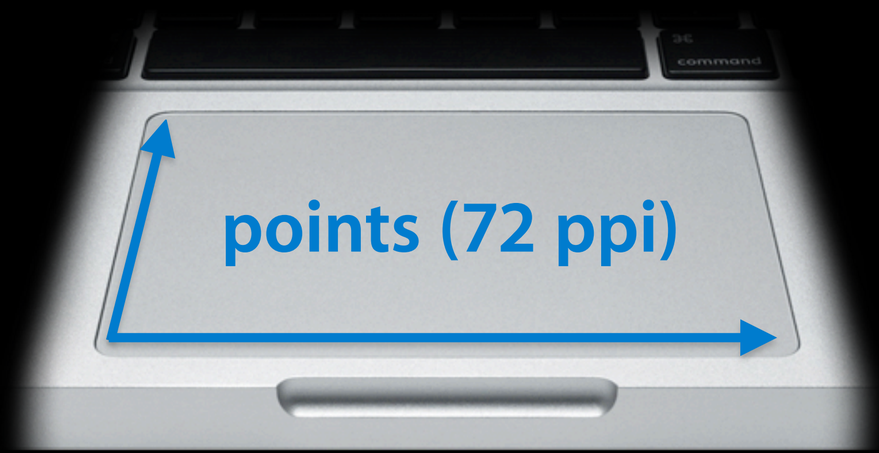
(NSSize) deviceSize

(id) device

Multi-Touch

NSTouch

New



(NSTouchPhase) phase

(id) identity

(BOOL) isResting

(NSPoint) normalizedPosition

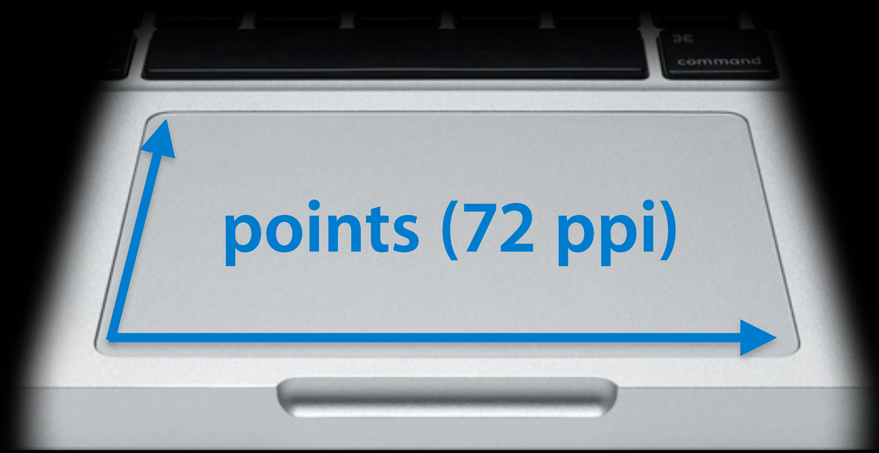
(NSSize) deviceSize

(id) device

Multi-Touch

NSTouch

New



(NSTouchPhase) phase

(id) identity

(BOOL) isResting

(NSPoint) normalizedPosition

(NSSize) deviceSize

(id) device

Multi-Touch

NSTouch

New

(NSTouchPhase) phase

(id) identity

(BOOL) isResting

(NSPoint) normalizedPosition

(NSSize) deviceSize

(id) device

Multi-Touch

Opt-in

```
@interface NSView
...
- (void)setAcceptsTouchEvents:(BOOL)flag;
- (BOOL)acceptsTouchEvents;

- (void)setWantsRestingTouches:(BOOL)flag;
- (BOOL)wantsRestingTouches;
...
@end
```

Multi-Touch

Opt-in

```
@interface NSView
...
- (void)setAcceptsTouchEvents:(BOOL)flag;
- (BOOL)acceptsTouchEvents;

- (void)setWantsRestingTouches:(BOOL)flag;
- (BOOL)wantsRestingTouches;
...
@end
```

Multi-Touch

Opt-in

```
@interface NSView
...
- (void)setAcceptsTouchEvents:(BOOL)flag;
- (BOOL)acceptsTouchEvents;

- (void)setWantsRestingTouches:(BOOL)flag;
- (BOOL)wantsRestingTouches;
...
@end
```

Multi-Touch

NSResponder methods

```
- (void)touchesBeganWithEvent:(NSEvent *)event
- (void)touchesMovedWithEvent:(NSEvent *)event
- (void)touchesEndedWithEvent:(NSEvent *)event
- (void)touchesCancelledWithEvent:(NSEvent *)event
```

Multi-Touch

NSEvent methods

```
- (NSSet *)touchesMatchingPhase:(NSTouchPhase)phase inView:(NSView *)view
```

Multi-Touch

NSEvent methods

…MatchingPhase:

NSTouchPhaseMoved | NSTouchPhaseStationary

Multi-Touch

NSEvent methods

…MatchingPhase:

NSTouchPhaseTouching = Began | Moved | Stationary

Multi-Touch

NSEvent methods

…MatchingPhase:

NSTouchPhaseTouching = Began | Moved | Stationary

NSTouchPhaseAny

Multi-Touch

Sample code

```
- (void)touchesBeganWithEvent:(NSEvent *)event {
    NSSet *touches = [event
                      touchesMatchingPhase:NSTouchPhaseTouching
                      inView:self.view];

    if(touches.count == 2) {
        // Setup for 2 touch tracking
    } else if(touches.count > 2) {
        // More than 2 touches. Only track 2.
        [self cancelTracking];
    }
}
```

Multi-Touch

Sample code

New

```
- (void)touchesBeganWithEvent:(NSEvent *)event {
    NSSet *touches = [event
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Multi-Touch

Sample code

```
- (void)touchesBeganWithEvent:(NSEvent *)event {
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}
```

Multi-Touch

Sample code

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    NSSet *touches = [event
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    } else if(touches.count > 2) {
        // More than 2 touches. Only track 2.
        [self cancelTracking];
    }
}
```

Multi-Touch

Best practices

- Selectively ignore events
- Consider tracking thresholds
- Forward gesture events to nextResponder

Multi-Touch

Concurrent events

Touch

Touch
Mouse

Touch
Gesture

Multi-Touch

Best practices

- Selectively ignore events
- Consider tracking thresholds
- Forward gesture events to nextResponder

Multi-Touch

Best practices

- Selectively ignore events
- Consider tracking thresholds
- Forward gesture events to nextResponder

Multi-Touch

Best practices

- Selectively ignore events
- Consider tracking thresholds
- Forward gesture events to nextResponder

Multi-Touch vs. Gestures

touchesBegan
touchesMoved
touchesEnded
touchesCancelled

vs.

Magnify
Rotate
Swipe

Event Big Brother

Funnel Points

```
-(void)sendEvent:(NSEvent *)theEvent
```

Event Monitoring

- Local monitors
- Global monitors

Event Monitoring

Local

```
@interface NSEvent ...
+ (id)addLocalMonitorForEventsMatchingMask:(NSEventMask)mask
       handler:(NSEvent* (^)(NSEvent*))block;
```

- Events that are targeted for your app
- Can modify the event
- No events from tracking loop
- Hold on to returned object

Event Monitoring

Local

```
@interface NSEvent ...
+ (id)addLocalMonitorForEventsMatchingMask:(NSEventMask)mask
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Event Monitoring

Local

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Event Monitoring

Local

```
@interface NSEvent ...
+ (id)addLocalMonitorForEventsMatchingMask:(NSEventMask)mask
       handler:(NSEvent* (^)(NSEvent*))block;
```

- Events that are targeted for your app
- Can modify the event
- No events from tracking loop
- Hold on to returned object

Event Monitoring

Global

```
@interface NSEvent ...
+ (id)addGlobalMonitorForEventsMatchingMask:(NSEventMask)mask
       handler:(void (^)(NSEvent*))block;
```

- No events already targeted to your application
- Observe only
- No key events
- Hold on to returned object

Event Monitoring

Global

```
@interface NSEvent ...
+ (id)addGlobalMonitorForEventsMatchingMask:(NSEventMask)mask
       handler:(void (^)(NSEvent*))block;
```

- No events already targeted to your application
- Observe only
- No key events
- Hold on to returned object

Event Monitoring

Removing event monitors

- Cocoa manages event monitors
- Event monitors must explicitly be removed

```
@interface NSEvent ...
+ (void)removeMonitor:(id)eventMonitor;
```

Demo

Event Monitoring

A word of caution

New

Potential performance impact

Sample Code for This Session

User events in Cocoa

- Download the sample code
  - “TargetGallery”
  - “LightTable”

Materials available at:
http://developer.apple.com/wwdc/attendee/

Documentation

Cocoa Event-Handling Guide: Event Architecture

http://developer.apple.com/documentation/Cocoa/Conceptual/EventOverview/EventArchitecture/EventArchitecture.html

Application Menu and Pop-up List Programming Topics for Cocoa

http://developer.apple.com/documentation/Cocoa/Conceptual/MenuList/Articles/EnablingMenuItems.html

Error Handling Programming Guide for Cocoa

http://developer.apple.com/documentation/Cocoa/Conceptual/ErrorHandlingCocoa/ErrorHandling/ErrorHandling.html

Cocoa Event-Handling Guide: Using Tracking-Area Objects

http://devworld.apple.com/documentation/Cocoa/Conceptual/EventOverview/TrackingAreaObjects/chapter_7_section_1.html

Documentation

Cocoa Event-Handling Guide: Handling Mouse Events

http://developer.apple.com/documentation/Cocoa/Conceptual/EventOverview/HandlingMouseEvents/HandlingMouseEvents.html

Cocoa Release Notes

Q&A

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